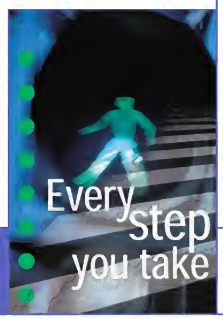
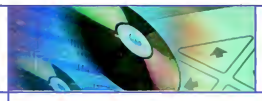
Substation Automation and Protection Training



RET 670 Transformer Protection Training



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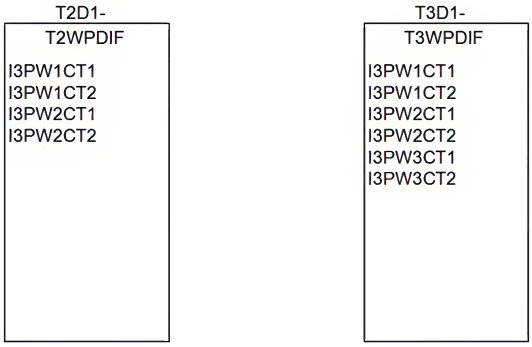
RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Two-winding or three-winding
    - Two-winding variant up to 4 three-phase CT inputs
    - Three-winding variant up to 6 three-phase CT inputs

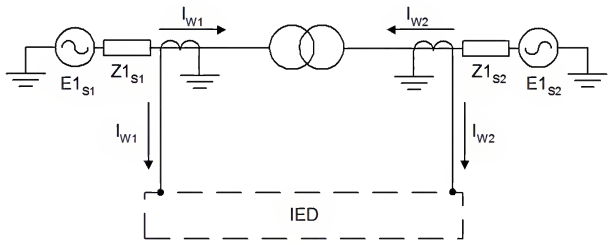


RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Up to two instances
    - Can protect two objects with one RET 670 IED, or one object that changes status
      - Two transformers
      - Generator / transformer separately
      - Generating status / pumping status for pump storage unit
  - Internal adaptation to power transformer vector group, turns ratio and CT ratios
  - Tap changer position monitoring for increased sensitivity

RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Main CT connections
    - Directly star-connected
    - Star-point can be either towards the transformer ('ToObject'), or away from the transformer ('FromObject')
  - Internally used reference direction
    - The flow of primary current on any side of the transformer is in the positive (reference) direction if it flows towards the transformer



RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Functionality
    - Fundamental frequency differential currents (per phase) – calculated as the vector sum of the same phase fundamental frequency currents from all sides of the transformer – all currents are referred to a common reference first
      - Phase reference: first star-connected winding (HV→MV → LV), otherwise if no star winding, first delta-connected winding (HV → MV → LV)
        - All current phasors are phase shifted to (referred to) the phase reference side
      - Magnitude reference: first winding (usually HV)
        - All current magnitudes are referred to the magnitude reference side (it is for this reason that all differential currents are normally expressed in HV-side primary Amperes)

RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Functionality
    - Two-winding transformer

$$\begin{bmatrix} IDL1 \\ IDL2 \\ IDL3 \end{bmatrix} = A \cdot \begin{bmatrix} IL1\_W1 \\ IL2\_W1 \\ IL3\_W1 \end{bmatrix} + \frac{Ur\_W2}{Ur\_W1} \cdot B \cdot \begin{bmatrix} IL1\_W2 \\ IL2\_W2 \\ IL3\_W2 \end{bmatrix}$$

Differential currents

Contribution from W1 side to differential currents

Contribution from W2 side to differential currents

RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Functionality
    - Three-winding transformer

$$\begin{bmatrix} IDL1 \\ IDL2 \\ IDL3 \end{bmatrix} = A \cdot \begin{bmatrix} IL1\_W1 \\ IL2\_W1 \\ IL3\_W1 \end{bmatrix} + \frac{Ur\_W2}{Ur\_W1} \cdot B \cdot \begin{bmatrix} IL1\_W2 \\ IL2\_W2 \\ IL3\_W2 \end{bmatrix} + \frac{Ur\_W3}{Ur\_W1} \cdot C \cdot \begin{bmatrix} IL1\_W3 \\ IL2\_W3 \\ IL3\_W3 \end{bmatrix}$$

Differential currents

Contribution from W1 side to differential currents

Contribution from W2 side to differential currents

Contribution from W3 side to differential currents

RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Functionality
    - Values for the A, B, C matrix coefficients depend on
      - Winding connection type, i.e. star (Y/y) or delta (D/d)
      - Transformer vector group, i.e. Yd1, Dy11 (which introduces a phase shift between winding currents in multiples of 30°)
      - Zero sequence current elimination set On / Off

RET 670 – Transformer Differential Protection

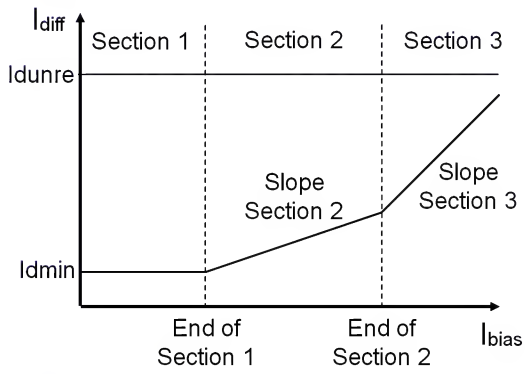
- Transformer differential protection (PDIF, 87T)
  - Functionality
    - Bias current
      - Single circuit breaker applications
        - Calculated as the highest fundamental frequency current from the individual winding current contributions to the differential currents
        - All individual winding current contributions are already referred to the magnitude reference (W1) side – for this reason, the bias current is usually expressed in HV-side primary Amperes
        - Single bias current is common to all three phases
      - Multiple circuit breaker applications, on any or all sides
        - From any side, the two separate three phase currents are included in the bias current calculation, as well as the resultant current (calculated) into the transformer winding

RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Functionality
    - Zero sequence current elimination
      - Selectable (per winding) – Setting: On / Off per winding
      - Elimination of the zero sequence currents is necessary to avoid unwanted trips for external earth faults whenever
        - The protected power transformer cannot transform the zero-sequence currents to the other side
        - The zero-sequence currents can only flow on one side of the protected power transformer
      - The zero sequence currents should be subtracted from the side of the power transformer where the zero sequence currents can flow for external earth faults
      - If the zero sequence currents are eliminated from the current contributions from any side to the differential currents, they are automatically eliminated from the bias current as well

RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Functionality
    - Three-section operate/restrain characteristic
    - Highset unrestrained limit
    - Reset ratio 0.95



Settings:
IdMin
IdUnre
EndSection1
EndSection2
SlopeSection2
SlopeSection3

RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Functionality
    - Unrestrained (i.e. non-stabilized) limit
      - For very big differential currents for which there should be no doubt that the fault is internal
      - Limit is constant
      - No harmonic or any other restrain is applied to this limit
      - Instantaneous tripping allowed

RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Functionality
    - Restrained (i.e. stabilized) characteristic
      - Compares the calculated fundamental differential (i.e. operating) currents, and the bias (i.e. restrain) current, by applying them to the operate - restrain characteristic – in this way the magnitudes of the individual fundamental frequency differential currents are compared to an adaptive limit – this limit is adaptive because it is dependent on the bias (i.e. restrain) current magnitude
      - 2^{nd}, 5^{th} and waveform restraint are applied to this characteristic
      - Tripping is only allowed if not blocked by one of the restraint criteria

RET 670 – Transformer Differential Protection

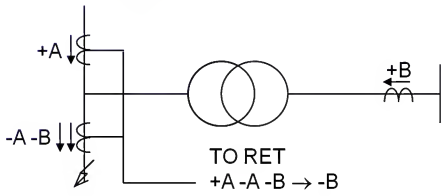
- Transformer differential protection (PDIF, 87T)
  - Functionality
    - Restrained (i.e. stabilized) characteristic
      - Section 1
        - Most sensitive part
        - Characteristic a straight line
        - Current flow normal load current
        - Typical reason for existence of false differential currents in this section is non compensation of tap position
      - Section 2
        - First slope (low percentage)
        - Caters for false differential currents when higher than normal currents flow through the current transformers

RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Functionality
    - Restrained (i.e. stabilized) characteristic
      - Section 3
        - Second slope (higher percentage)
        - Provides higher tolerance to substantial current transformer saturation for high through fault currents, which can be expected in this section
      - The characteristic settings should be made such that
        - for internal faults, the differential currents are always safely above the characteristic
        - for external faults, any unwanted (false) differential currents are always safely below the characteristic

RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Functionality
    - Through-fault stability for multi-breaker arrangements
      - Ideal CTs, external current summation

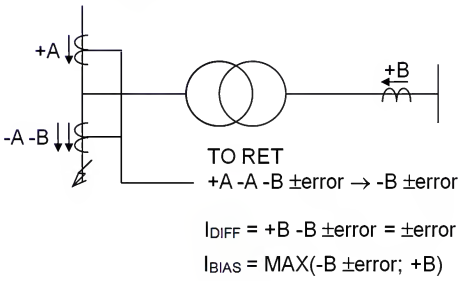


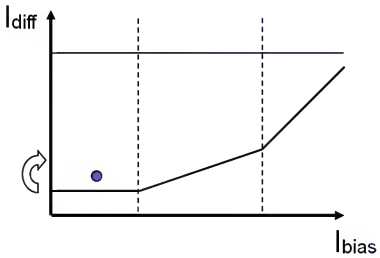
I_{DIFF} = +B -B = 0

I_{BIAS} = MAX(-B; +B)

RET 670 – Transformer Differential Protection

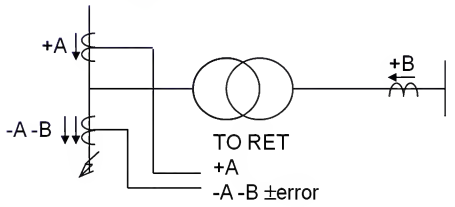
- Transformer differential protection (PDIF, 87T)
  - Functionality
    - Through-fault stability for multi-breaker arrangements
      - Real CTs, external current summation

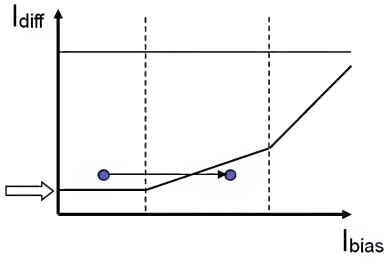


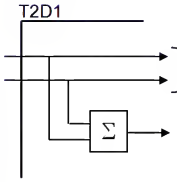


RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Functionality
    - Through-fault stability for multi-breaker arrangements
      - Real CTs, internal current summation







to I_{BIAS} calculation

to I_{DIFF} & I_{BIAS} calculation

I_{DIFF} = +A -A -B ±error +B = ±error

I_{BIAS} = MAX(-B ±error; +B; +A; -A -B ±error)

RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Functionality
    - Blocking criteria (phase segregated)
      - Instantaneous differential currents are calculated on which the harmonic and waveform analyses are performed – the same matrix equations are used as for the fundamental frequency currents, except now instantaneous values (i.e. sampled values) are used instead
      - Harmonic restrain
        - Required to prevent unwanted tripping due to magnetizing inrush currents, or due to magnetizing currents caused by overvoltages – magnetizing currents flow only on one side of a power transformer, and are therefore always a cause of false differential currents
        - Harmonic analysis is applied to the instantaneous differential currents, and then only to those phases with a start from the operate-restrain characteristic (phase segregated)

RET 670 – Transformer Differential Protection

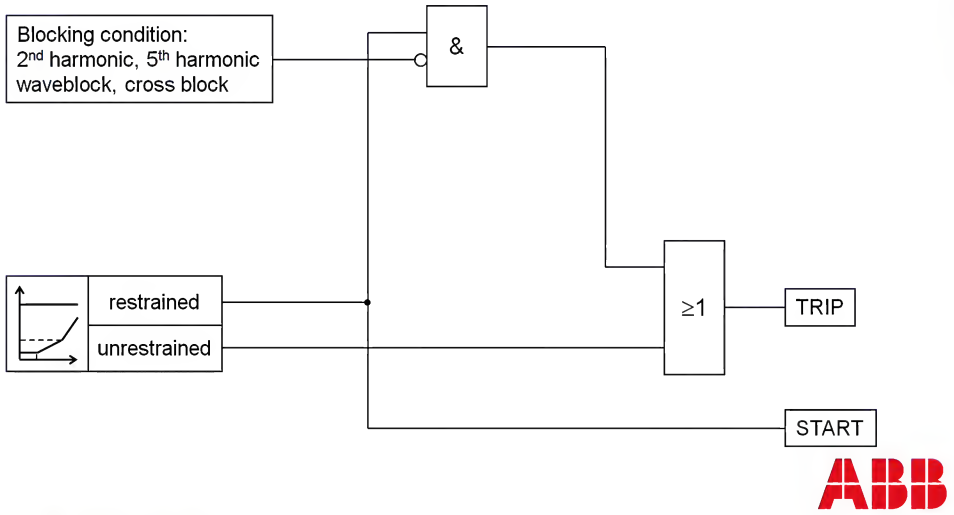
- Transformer differential protection (PDIF, 87T)
  - Functionality
    - Blocking criteria (continued)
      - Waveform restrain
        - Based on waveform recognition – looks for the intervals within each power system cycle with low rate-of-change in the instantaneous differential currents that are typical to power transformer inrush currents
      - Cross-blocking between phases
        - If a blocking condition is detected in any phase, this phase can cross-block to the other phases, but only if it has registered a start from its operate-restrain characteristic, i.e. a phase may only cross-block the other phases if it is itself blocked

RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Functionality
    - Blocking criteria (continued)
      - 2nd harmonic – inrush, CT saturation
        - Settings: On / Off + settable level
      - Waveform – inrush
        - Settings: None
      - 5th harmonic – overexcitation
        - Settings: On / Off + settable level
      - Cross-blocking between phases
        - Setting: On / Off

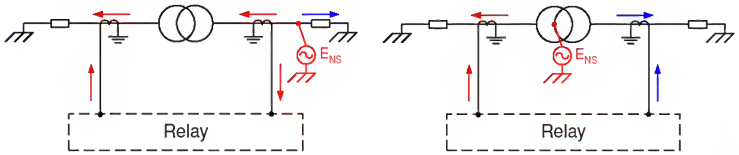
RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Overview of traditional transformer differential protection function



RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Internal / External fault discriminator
    - Fault position (internal / external) can be determined by comparing the direction of flow of the negative sequence currents on all sides of the transformer
    - This is done by simply determining the position of the source of the negative sequence currents with respect to the zone of protection – the source of the negative sequence currents is at the point of fault
    - External fault: the negative sequence currents will have a relative phase displacement of 180°
    - Internal fault: the negative sequence currents will have a relative phase displacement of about 0°



RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Internal / External fault discriminator
    - What about transformation ratio and phase shift?
    - Before comparison, the negative sequence currents must first be referred to the same phase reference side, and put to the same magnitude reference
    - Modern numerical transformer differential relays use matrix equations to compensate for vector group and turns ratio
    - Negative sequence differential currents can be calculated using the same matrix equations – in this way all negative sequence current components are automatically compensated for power transformer vector group and turns ratio
    - The 0° / 180° criterion is then still valid

RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Internal / External fault discriminator
    - Example YNd5 transformer

$$\begin{bmatrix} IDL1\_NS \\ IDL2\_NS \\ IDL3\_NS \end{bmatrix} = \frac{1}{3} \cdot \begin{bmatrix} 2 & -1 & -1 \\ -1 & 2 & -1 \\ -1 & -1 & 2 \end{bmatrix} \cdot \begin{bmatrix} INS\_W1 \\ a \cdot INS\_W1 \\ a^2 \cdot INS\_W1 \end{bmatrix} + \frac{Ur\_W2}{Ur\_W1} \cdot \frac{1}{\sqrt{3}} \cdot \begin{bmatrix} -1 & 0 & 1 \\ 1 & -1 & 0 \\ 0 & 1 & -1 \end{bmatrix} \cdot \begin{bmatrix} INS\_W2 \\ a \cdot INS\_W2 \\ a^2 \cdot INS\_W2 \end{bmatrix}$$

NS differential current

NS contribution from W1 side to NS differential currents

NS contribution from W2 side to NS differential currents

RET 670 – Transformer Differential Protection

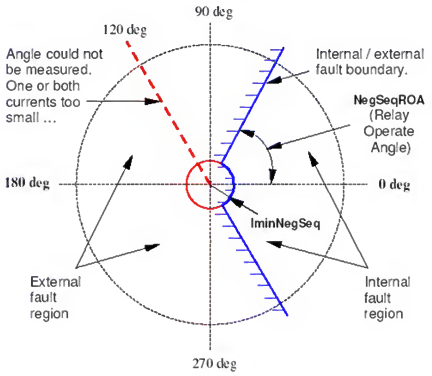
- Transformer differential protection (PDIF, 87T)
  - Internal / External fault discriminator
    - Two-winding transformers
      - Operation of the internal / external fault discriminator is based on the relative position of the two phasors representing the HV/LV (W1/W2) negative sequence current contributions, i.e. on a directional comparison between these two phasors
    - Three-winding transformers
      - Operation of the internal / external fault discriminator is based on similar principles
      - Three directional comparisons are made

RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Internal / External fault discriminator
    - The Internal / External fault discriminator works equally well for symmetrical 3-phase faults
      - When a symmetrical 3-phase fault occurs, negative sequence currents (the negative sequence current source) will be present until the dc component in the fault currents die out
      - This interval of time is long enough for the internal / external fault discriminator to declare either an internal or an external fault

RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Internal / External fault discriminator
    - Characteristic



Settings:

IMinNegSeq

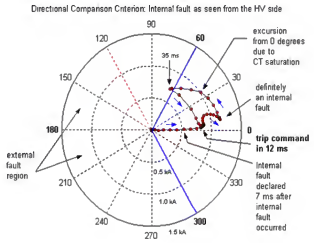
NegSeqROA

RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Internal / External fault discriminator
    - Operation (two-winding transformer)
      - The LV-side phasor is positioned along the zero degree line – then the relative position of the HV-side phasor in the complex plain is determined
      - To perform the directional comparison, the magnitudes of both phasors must be high enough to ensure that they are due to a fault, i.e. both must be greater than the settable limit IminNegSeq
      - To guarantee good sensitivity, this IminNegSeq limit must not be set too high
      - If the magnitude of any one of the phasors is below the limit, no directional comparison will be made – the internal / external fault discriminator will not operate during transformer energization (inrush)
      - The settable relay operate angle NegSeqROA determines the boundary between the internal and external fault regions

RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Internal / External fault discriminator
    - CT saturation
      - During heavy faults, CT saturation might cause the measured phase angle to differ from 180° for external faults, and from about 0° for internal faults
      - Effective means to counteract the negative effects of main CT saturation have been integrated into the algorithm
      - At heavy faults, approximately 5ms time-to-saturation of the main CT is sufficient in order to produce a correct discrimination between internal and external faults



RET 670 – Transformer Differential Protection

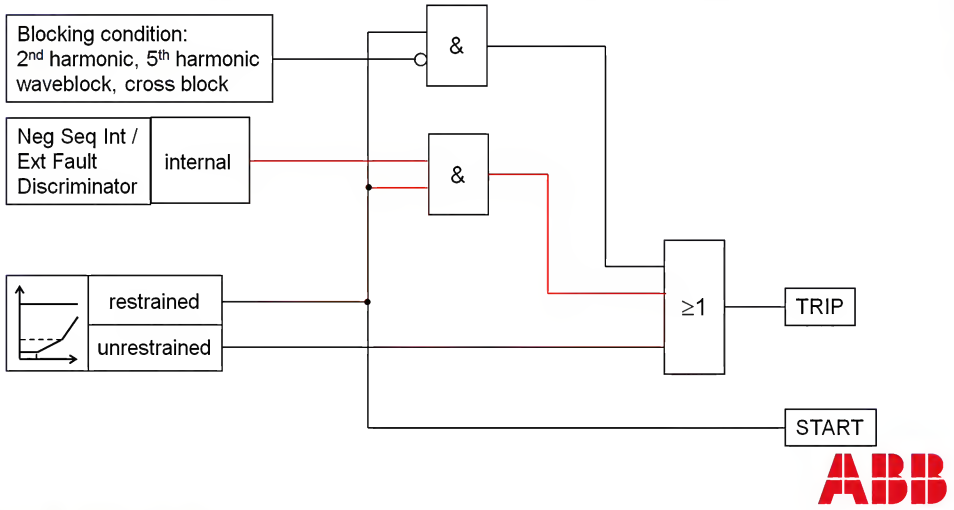
- Transformer differential protection (PDIF, 87T)
  - Internal / External fault discriminator
    - Features of Internal / External fault discriminator
      - Discriminates between internal and external faults with very high dependability
      - Detects even minor faults with high sensitivity and high speed
    - High performance differential protection is achieved by combining the good properties of traditional differential protection with advanced features of the internal / external fault discriminator
      - Unrestrained negative sequence differential protection
      - Sensitive negative sequence protection

RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Internal / External fault discriminator
    - Unrestrained negative sequence differential protection
      - A start from the ordinary differential protection is required to activate the unrestrained negative sequence differential protection
      - If the internal / external fault discriminator categorizes this same fault as internal, the blocking supervision is bypassed, and the trip output is generated without any further delay
      - This logic guarantees a fast operating time, even for heavy internal faults with severely saturated current transformers – harmonic distortions do not slow down the differential protection operation
      - If the fault is categorized as external, the traditional differential protection is NOT blocked, but additional trip criteria are posed to ensure high external fault stability

RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Overview of unrestrained negative sequence differential protection in conjunction with traditional transformer differential protection

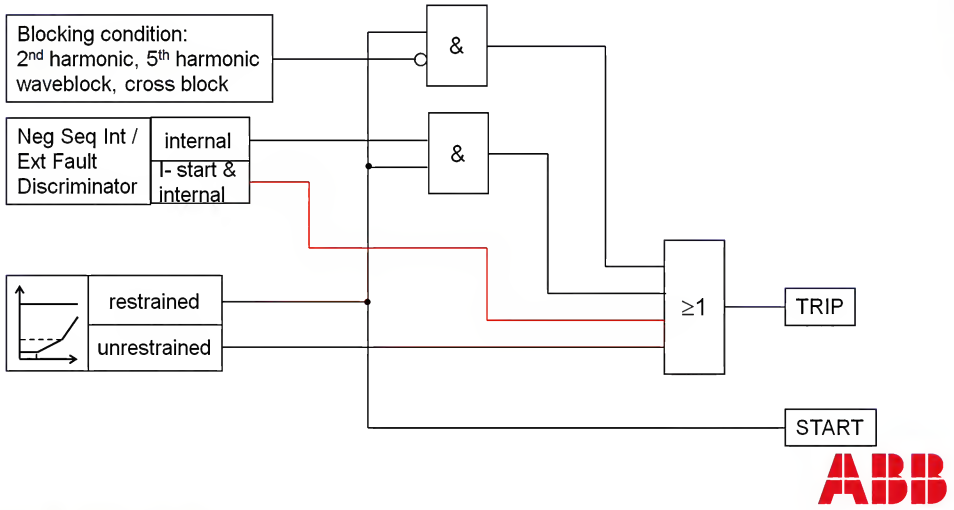


RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Internal / External fault discriminator
    - Sensitive negative sequence protection
      - Gives sensitive turn-to-turn fault protection
      - Independent from the traditional differential protection
      - No start from the ordinary differential protection is required to activate the sensitive negative sequence differential protection
      - If the internal / external fault discriminator categorizes the disturbance as internal, a separate trip request is placed – this trip request must be confirmed several times in succession before the final trip request is placed – this security feature results in an increase in the operating time
      - Nevertheless, the operating time is about 30ms for very low-level turn-to-turn faults

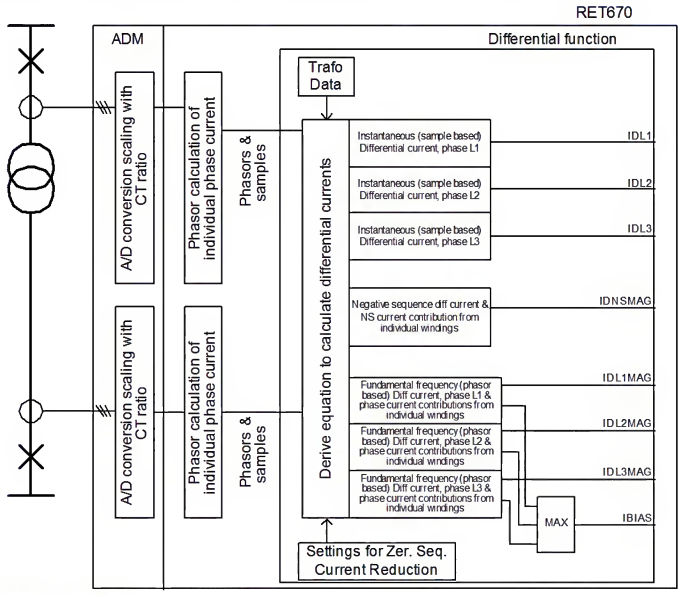
RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Overview of sensitive negative sequence protection



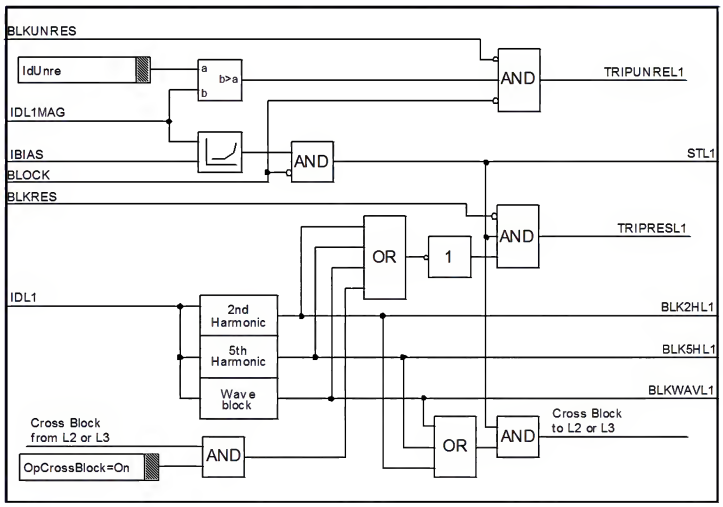
RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)



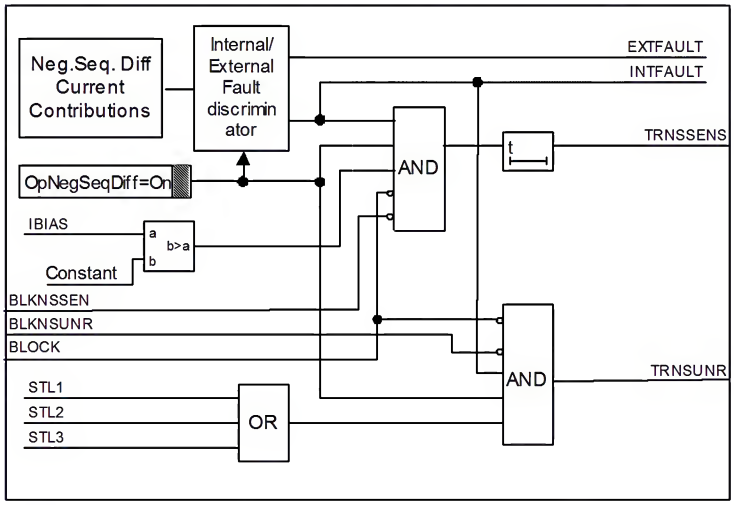
RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Simplified logic diagram for phase L1



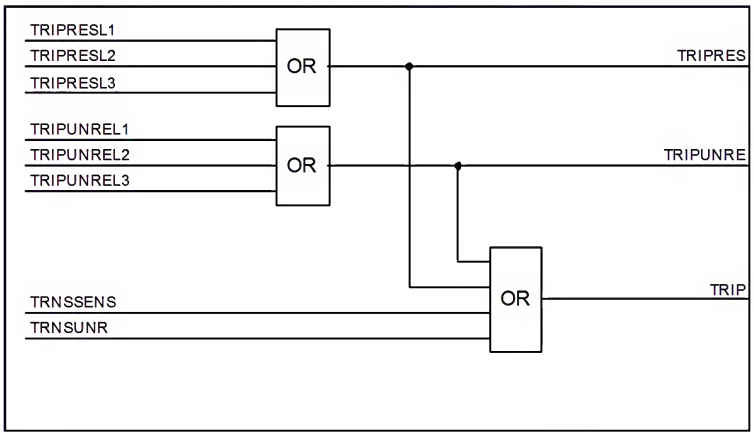
RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Simplified logic diagram for internal / external fault discriminator



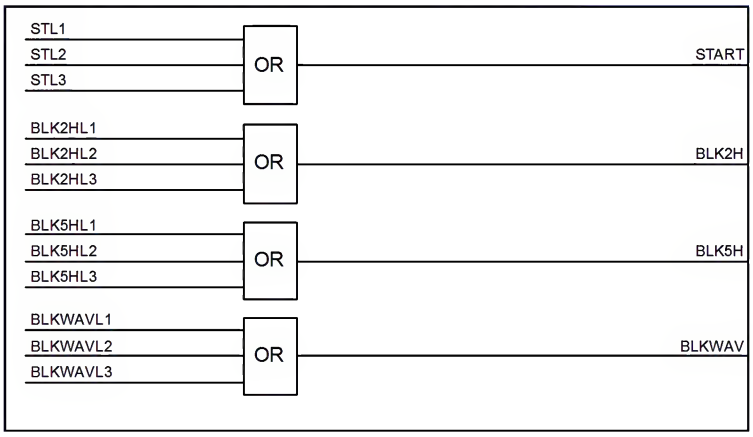
RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Internal grouping of Trip signals



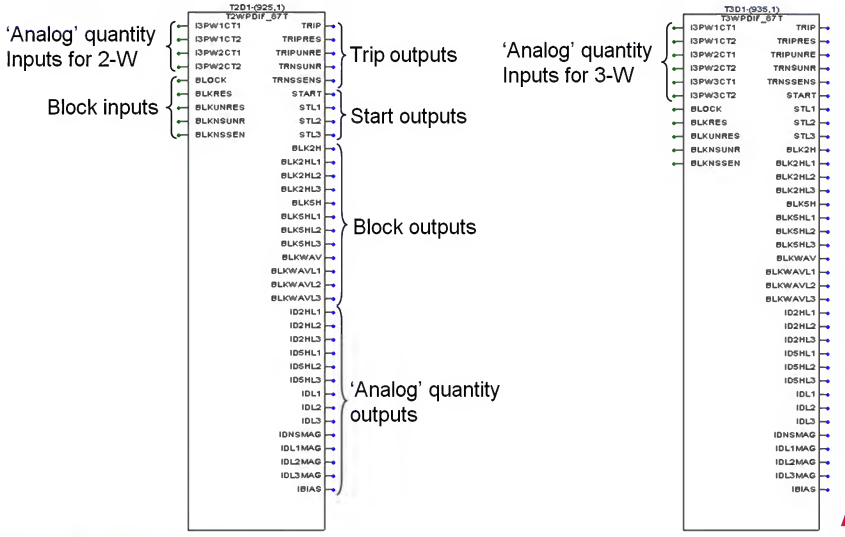
RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Internal grouping of Start and Block signals

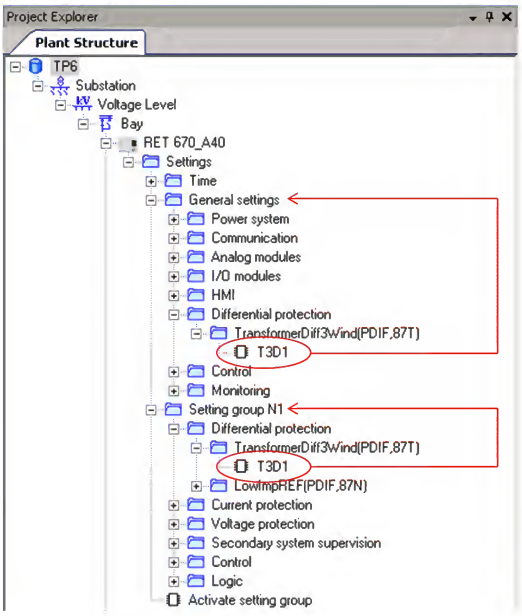


RET 670 – Transformer Differential Protection

- Transformer differential protection (PDIF, 87T)
  - Functions blocks for two- and three-winding functions



RET 670 – Transformer Differential Protection - Settings



RET 670 – Transformer Differential Protection - Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max
T3D1					
RatedVoltageW1		400,00	kV	0,05	2000,00
RatedVoltageW2		231,00	kV	0,05	2000,00
RatedVoltageW3		10,50	kV	0,05	2000,00
RatedCurrentW1		577	A	1	99999
RatedCurrentW2		1000	A	1	99999
RatedCurrentW3		7173	A	1	99999
ConnectTypeW1		WYE (Y)			
ConnectTypeW2		wye = y			
ConnectTypeW3		Delta = d			
ClockNumberW2		0 [0 deg]			
ClockNumberW3		5 [150 deg lag]			
ZSCurrSubtrW1		On			
ZSCurrSubtrW2		On			
ZSCurrSubtrW3		On			
TconfigForW1		No			
CT1RatingW1		3000	A	1	99999
CT2RatingW1		3000	A	1	99999
TconfigForW2		No			
CT1RatingW2		3000	A	1	99999
CT2RatingW2		3000	A	1	99999
TconfigForW3		No			
CT1RatingW3		3000	A	1	99999
CT2RatingW3		3000	A	1	99999

Settings
General settings
Differential protection
TransformerDiff3Wind(PDIF,87T)

RET 670 – Transformer Differential Protection - Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max
T3D1					
RatedVoltageW1		400,00	kV	0,05	2000,00
RatedVoltageW2		231,00	kV	0,05	2000,00
RatedVoltageW3		10,50	kV	0,05	2000,00
RatedCurrentW1		577	A	1	99999
RatedCurrentW2		1000	A	1	99999
RatedCurrentW3		7173	A	1	99999
ConnectTypeW1		WYE (Y)			
ConnectTypeW2		wye = y			
ConnectTypeW3		Delta = d			
ClockNumberW2		0 [0 deg]			
ClockNumberW3		5 [150 deg lag]			
ZSCurrSubtrW1		On			
ZSCurrSubtrW2		On			
ZSCurrSubtrW3		On			
TconfigForW1		No			
CT1RatingW1		3000	A	1	99999
CT2RatingW1		3000	A	1	99999
TconfigForW2		No			
CT1RatingW2		3000	A	1	99999
CT2RatingW2		3000	A	1	99999
TconfigForW3		No			
CT1RatingW3		3000	A	1	99999
CT2RatingW3		3000	A	1	99999

RET 670 – Transformer Differential Protection - Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max
T3D1					
RatedVoltageW1		400,00	kV	0,05	2000,00
RatedVoltageW2		231,00	kV	0,05	2000,00
RatedVoltageW3		10,50	kV	0,05	2000,00
RatedCurrentW1		577	A	1	99999
RatedCurrentW2		1000	A	1	99999
RatedCurrentW3		7173	A	1	99999
ConnectTypeW1		WYE (Y)			
ConnectTypeW2		wye = y			
ConnectTypeW3		Delta = d			
ClockNumberW2		0 [0 deg]			
ClockNumberW3		5 [150 deg lag]			
ZSCurrSubtrW1		On			
ZSCurrSubtrW2		On			
ZSCurrSubtrW3		On			
TconfigForW1		No			
CT1RatingW1		3000	A	1	99999
CT2RatingW1		3000	A	1	99999
TconfigForW2		No			
CT1RatingW2		3000	A	1	99999
CT2RatingW2		3000	A	1	99999
TconfigForW3		No			
CT1RatingW3		3000	A	1	99999
CT2RatingW3		3000	A	1	99999

WYE (Y); Delta (D)

wye = y; Delta = d

0 [0 deg]; 1 [30 deg lag];
2 [60 deg lag]; 3 [90 deg lag];
4 [120 deg lag]; 5 [150 deg lag];
6 [180 deg]; 7 [150 deg lead];
8 [120 deg lead]; 9 [90 deg lead];
10 [60 deg lead]; 11 [30 deg lead]

RET 670 – Transformer Differential Protection - Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max
T3D1					
RatedVoltageW1		400,00	kV	0,05	2000,00
RatedVoltageW2		231,00	kV	0,05	2000,00
RatedVoltageW3		10,50	kV	0,05	2000,00
RatedCurrentW1		577	A	1	99999
RatedCurrentW2		1000	A	1	99999
RatedCurrentW3		7173	A	1	99999
ConnectTypeW1		WYE (Y)			
ConnectTypeW2		wye = y			
ConnectTypeW3		Delta = d			
ClockNumberW2		0 [0 deg]			
ClockNumberW3		5 [150 deg lag]			
ZSCurrSubtrW1		On			
ZSCurrSubtrW2		On			
ZSCurrSubtrW3		On			
TconfigForW1		No			
CT1RatingW1		3000	A	1	99999
CT2RatingW1		3000	A	1	99999
TconfigForW2		No			
CT1RatingW2		3000	A	1	99999
CT2RatingW2		3000	A	1	99999
TconfigForW3		No			
CT1RatingW3		3000	A	1	99999
CT2RatingW3		3000	A	1	99999

Off; On

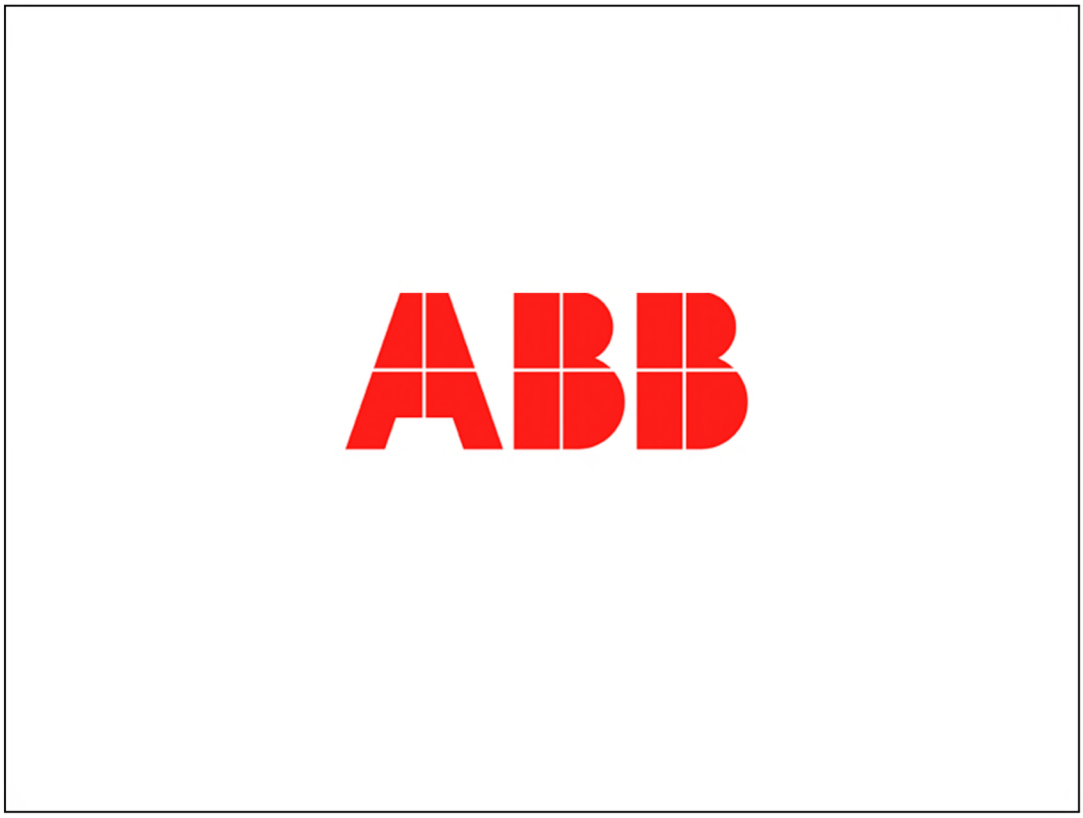
RET 670 – Transformer Differential Protection - Settings

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	
T3D1						
RatedVoltageW1		400,00	kV	0,05	2000,00	
RatedVoltageW2		231,00	kV	0,05	2000,00	
RatedVoltageW3		10,50	kV	0,05	2000,00	
RatedCurrentW1		577	A	1	99999	
RatedCurrentW2		1000	A	1	99999	
RatedCurrentW3		7173	A	1	99999	
ConnectTypeW1		WYE (Y)				
ConnectTypeW2		wye = y				
ConnectTypeW3		Delta = d				
ClockNumberW2		0 [0 deg]				
ClockNumberW3		5 [150 deg lag]				
ZSCurrSubtrW1		On				
ZSCurrSubtrW2		On				
ZSCurrSubtrW3		On				
TconfigForW1		No				No; Yes
CT1RatingW1		3000	A	1	99999	
CT2RatingW1		3000	A	1	99999	
TconfigForW2		No				No; Yes
CT1RatingW2		3000	A	1	99999	
CT2RatingW2		3000	A	1	99999	
TconfigForW3		No				No; Yes
CT1RatingW3		3000	A	1	99999	
CT2RatingW3		3000	A	1	99999	

RET 670 – Transformer Differential Protection - Settings

Settings
Settings group N1
Differential protection
TransformerDiff3Wind(PDIF,87T)

Group / Parameter Name	IED Value	PC Value	Unit	Min	Max	
T3D1						
Operation		Off				Off; On
IdMin		0,30	IB	0,10	0,60	
EndSection1		1,25	IB	0,20	1,50	
EndSection2		3,00	IB	1,00	10,00	
SlopeSection2		40,0	%	10,0	50,0	
SlopeSection3		80,0	%	30,0	100,0	
IdUnre		10,00	IB	1,00	50,00	
I2/I1Ratio		15,0	%	5,0	100,0	
I5/I1Ratio		25,0	%	5,0	100,0	
OpCrossBlock		On				Off; On
OpNegSeqDiff		On				Off; On
IMinNegSeq		0,04	IB	0,02	0,20	
NegSeqROA		60,0	Deg	30,0	120,0	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